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Improving Stakeholder Harmonisation and Policy Development Processes in the National System of Innovation

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ABSTRACT

The governance of innovation is a major challenge within the broad discourse on the successful formulation and implementation of innovation policy. This study adopted a qualitative research approach and case study design to analyse the policy development processes and stakeholder harmonisation in the South African National System of Innovation (NSI). Interviews were conducted with 30 actors within the NSI. The study's findings about the NSI policy development are consistent with South Africa's approach to involving stakeholders in policy-making. However, a notable gap in broad-based participation was identified, indicating that policy development is not adequately filtered across the entire innovation landscape. This gap has led to a misunderstanding about responsibilities and NSI actors' contributions to the NSI, negatively affecting the harmonisation of actors' roles. The study recommends addressing fragmentation and improving integration and communication through information sharing, community engagement, consultations, local and international partnerships and advancing policy development approaches.

1 | Introduction

The governance of innovation presents a significant challenge in the broader discussion surrounding effective innovation policy formulation and implementation (Biegelbauer 2019a, 1). This has mainly been due to the realisation that innovation systems are made up of complex networks of overlapping and multi-layered systems with different aims and objectives, operating at different levels. There is thus a pressing need for alignment, which the research shows cannot occur spontaneously. There is thus a concerted search for conscious institutional mechanisms to achieve coordination (Petersen and Kruss 2020, 48).

The South African 2019 White Paper on Science and Technology and the 2022 Science, Technology, and Innovation Decadal Plan (2022–2032) identified coordination, coherence, alignment and

inclusiveness as critical governance challenges that must be addressed for the success of the country's innovation policy (Department of Science and Innovation (DSI) 2019; Department of Science and Innovation (DSI) 2022). The innovation governance system remains fragmented, uncoordinated and incoherent (Petersen and Kruss 2020, 53). Additionally, inclusivity in innovation policymaking has proven to be a challenge due to historical inequalities, structural issues and socioeconomic disparities (Hofer et al. 2024).

As important as it is, innovation policy governance remains an under-researched topic (Edler and Fagerberg 2017a, 2017b, 17). In particular, the issue of how coordination, collaboration, and interaction between actors at the national, regional, and local levels can be achieved requires attention (Petersen and Kruss 2020, 48). Equally important is the issue of inclusive policymaking,

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with broad participation across society. The study aimed to highlight these challenges, underlining their criticality and the need for immediate attention. It also analysed the National System of Innovation (NSI) policy development processes and how NSI actors respond to the national policy imperatives of harmonisation.

The NSI actors encompass most government departments and their entities, industrial bodies, private companies, research institutions, non-governmental organisations (NGOs) and universities. The entities are directly involved in creating, diffusing, and using knowledge and innovation. They play active roles in research, development, innovation, education or commercialisation (Department of Science and Innovation (DSI) 2022).

The literature revealed various challenges to stakeholder harmonisation in policy development processes. These challenges include incoherent and disjointed agenda setting, poor interface among key stakeholders in government, the private sector (including State-Owned Enterprises (SOEs)) and poor coordination of Science, Technology and Innovation policy objectives and instruments (Department of Science and Technology 2024; Cullen et al. 2020).

To improve coordination, harmonisation, coherence, and integration of Science Technology Innovation (STI) macro and sectoral policies within government, an Inter-Ministerial Committee (IMC), chaired by the Minister responsible for Science and Innovation, was launched in 2021. In addition, the government established the Science, Technology and Innovation (STI) Plenary, which was inaugurated in 2023. (Department of Science and Innovation (DSI) 2019; Department of Science and Innovation (DSI) 2022). The role of the STI Plenary is to bring together NSI actors in government, the private sector and civil society to set the agenda for STI policy periodically and review progress in its implementation (Department of Science and Innovation (DSI) 2019).

Despite the ongoing efforts, disharmony remains a significant challenge in the NSI. This disharmony has led to duplication and fragmentation of efforts by NSI actors. Scott and Gong (2021) reflects on the challenges experienced by the actors who operate in silos. Since networking is not encouraged in policy formulation, this has contributed to poor policy coordination and alignment. The 2020 Department of Science Innovation (DSI) media statement of 9 December alludes to the second challenge being a duplication of efforts and resources, which the country cannot afford due to the lack of funds caused by the 2020 budget cuts by the government.

The paper provides a basis for the national departments to encourage engagement among the executives and staff so they may contribute to policy or consider engaging those organisations on drives. This will ensure policy capacity building and engagement. The rest of the paper is presented as follows: literature review, materials and methods, results, discussion and conclusion.

2 | Literature Review

The coupling model of the NSI is the foundation of this study as it is the most accurate depiction of the actors of the NSI (Gust and Natalia 2012). The coupling model assumes innovation as a

complex, interactive process with endless multidirectional feedback loops connecting innovation phases and actors. From the model's viewpoint, innovation is an intricate intra- and extra-organisational communication network linking various individual functions, the scientific community and the technology market (Nicolov and Badulescu 2012). In line with the coupling model, the NSI is framed within the view of innovation as a complex, interactive, relational process that involves multiple actors within and beyond the state. Moreover, their focus transcends individual actors intra-organisationally, taking a systems approach.

The coupling model has become an influential framework in public administration and innovation policy, especially as government organisations navigate the complexities of a rapidly changing societal landscape. This model highlights the importance of coordinating and integrating efforts across the innovation landscape to achieve effective innovation (Biegelbauer 2019b). As innovation policy has evolved from linear to interactive approaches, the coupling model is a strategic tool to enhance collaboration, knowledge sharing and alignment among diverse actors' activities.

The main reason for adopting the coupling model for the study is the understanding that effective governance depends more and more on collaboration with a network of stakeholders. Traditional public administration methods often use top-down linear models; however, new challenges require a more participatory and inclusive approach. The coupling model facilitates this by emphasising cooperation among government agencies, community organisations and private-sector partners, allowing them to leverage external knowledge and inputs to foster innovative solutions to pressing social issues (Edler and Fagerberg 2017a, 2017b).

Moreover, the coupling model aligns seamlessly with various recent theoretical developments, approaches and concepts in innovation policy. One of these is the concept of Agile Innovation, an approach that can enhance responsiveness and adaptability within public administration. Agile innovation, which prioritises iterative development and quick feedback cycles, helps government entities respond rapidly to changes in policy environments (Santos 2021). In this context, public organisations can facilitate more agile interactions between government departments and external partners, ensuring they can pivot quickly based on stakeholder feedback and new data.

Sustainability is another important aspect that enhances the relevance of the coupling model. It is a crucial issue for public administrations, especially within the framework of circular innovation, which aims to minimise waste and make the most of resources. This model encourages public agencies to rethink their resource management and service delivery strategies, promoting effective and sustainable practices (Rogers and Bali 2021). Additionally, the coupling model fosters collaboration among various levels of government and community organisations, helping to create comprehensive solutions to environmental challenges, aligning perfectly with the goals of circular innovation and sustainability. The need for a unified approach to Digital Innovation, a growing area of interest, further illustrates the relevance of the coupling model. As

government agencies increasingly integrate advanced technologies, such as data analytics, artificial intelligence and digital platforms, into how they function (Khan et al. 2022), effective coordination among departments becomes essential. The coupling model facilitates collaboration among Information Technology (IT) departments, service providers and policy-makers, ensuring that technological investments are aligned with public needs and priorities. This integration allows agencies to enhance service delivery, improve efficiency, and create a better user experience for constituents.

Literature indicates that countries with relatively strong national innovation systems, such as the United States of America (USA), and developing countries, such as Brazil, India, Botswana and Rwanda, face the same challenges as South Africa (Aizpurua et al. 2022). An analysis of their national innovation systems' responses to these challenges has underlined the importance of a clear vision for a National System of Innovation through coherent agenda setting, solid linkages and networks, clarity of roles among NSI actors, better horizontal coordination within the public sector; a well-coordinated system for monitoring, evaluation and learning; and a supportive legislative and regulatory environment for innovation (Atkins 2021; Lee et al. 2021; Yongabo and Göransson 2022).

The United States and India have initiated various strategies to improve stakeholder harmonisation within their NSIs. For instance, India's Science, Technology and Innovation (STI) Policy of 2020, formulated by the Department of Science and Technology (DST), emphasises a collaborative framework aimed at strengthening interconnectedness across the NSI (Ngawang et al. 2022).

In the US context, Lee et al. (2021) noted that the country's innovation system has a diverse and wide range of actors contributing to implementing the NSI, though the system is not centralised. Even though the NSI is decentralised, the actors are more established and do interact. Some linkages can be drawn among the actors, which South Africa may use as a benchmark to benefit the country's NSI. While competition drives innovation, working together fosters cooperation and innovation (Atkins 2021). This is an important mechanism for enabling innovation, particularly as open innovation, another growing area of interest, is embraced by more organisations. The US system includes a high level of R&D with a strong focus on applications and the market, and basic research is funded by federal government agencies. The actors are the government, public agencies, universities, the private sector and non-profit organisations.

Botswana's transformation from one of the poorest nations in the world to a competitive middle-income economy illustrates, among other things, successful NSI development. The country has maintained a national innovation policy for over a decade, focusing on policy relevance, awareness and implementation (Hahn et al. 2010b). The NSI in Botswana is structured hierarchically across three levels: the innovation policy level, which sets the overarching framework and strategic direction for innovation; the institutional support level, which includes key organisations that provide necessary resources

and infrastructure; and the programmatic support level, which focuses on implementing specific initiatives and projects. Organisations like the Rural Industries Promotion Company (RIPCO) and the Local Enterprise Authority (LEA) play vital roles in this structure by driving technology adaptation and supporting the development of engineering capabilities within universities (Casadella and Tahi 2022). The Vision 2020 initiative in Rwanda emphasises the country's dedication to evolving into a knowledge-based economy. The Republic of Rwanda. National Council for Science and Technology (2020) identifies crucial sectors, including Information Communication Technologies (ICTs), science and technology and education. This policy framework is notable for its strong vertical integration of objectives across various domains, ensuring cohesive progress (Ministry of ICT and Innovation 2020). In contrast, Correia et al. (2021) highlight the limitations of high-level frameworks in effectively promoting policy coordination and harmonisation.

3 | Materials and Methods

This study adopted a case study design and key informant interviews focusing on the NSI actors. A case study emphasises an in-depth examination of the situation (Bryman 2016). The sample comprised the Department of Science and Innovation (DSI), the National Research Foundation (NRF), Selected National Universities and the Technology Innovation Agency (TIA). Purposive sampling was used to select the key informants. Purposive sampling is a non-probability sampling technique in which researchers intentionally select participants based on specific characteristics, traits, or expertise relevant to their research question. Instead of randomly choosing subjects, researchers use their judgement to identify individuals who are most likely to provide rich, meaningful and in-depth data. This method is often employed in qualitative research, such as case studies or interviews, where the aim is to explore complex phenomena rather than generalise findings to a larger population (Yin 2018).

Table 1 presents the target population and the sample size.

Table 2 shows the profile of the respondents.

TABLE 1 | Population and sample size.

Organisation	Population	Sample
Department of Science and Innovation (DSI)	10	7
National Research Foundation (NRF)	14	14
Selected National Universities (SNU)	10	6
Technology Innovation Agency (TIA)	5	3
Total	39	30

Source: Authors.

TABLE 2 | Profile of respondents.

No.	Key informants	Designation
1.	Respondent 1	DSI Chief Director
2.	Respondent 2	DSI Director
3.	Respondent 3	DSI Assistant Director
4.	Respondent 4	DSI Deputy Director
5.	Respondent 5	DSI Deputy Director
6.	Respondent 6	DSI Deputy Director
7.	Respondent 7	DSI Deputy Director
8.	Respondent 8	NRF Liaison officer
9.	Respondent 9	NRF Liaison officer
10.	Respondent 10	SNU lecturer
11.	Respondent 11	SNU lecturer
12.	Respondent 12	SNU lecturer
13.	Respondent 13	SNU lecturer
14.	Respondent 14	NRF Liaison officer
15.	Respondent 15	NRF Professional officer
16.	Respondent 16	NRF Director
17.	Respondent 17	NRF Program Head
18.	Respondent 18	NRF Manager
19.	Respondent 19	NRF Director
20.	Respondent 20	SNU Senior lecturer
21.	Respondent 21	NRF Manager
22.	Respondent 22	NRF Professional officer
23.	Respondent 23	SNU Senior lecturer
24.	Respondent 24	NRF Executive director
25.	Respondent 25	NRF director
26.	Respondent 26	NRF Professional officer
27.	Respondent 27	NRF Director
28.	Respondent 28	TIA Director
29.	Respondent 29	TIA Professional officer
30.	Respondent 30	TIA Professional officer

Source: Authors.

Responses were analysed using thematic analysis. The thematic analysis emphasises identifying, analysing and interpreting patterns of meaning within qualitative data (Yin 2018). Data was captured, coded and interpreted with Atlas.ti software (Yin 2018).

4 | Results

This section presents the results reflecting the NSI policy development processes as articulated by the respondents. The results

reflect on institutional policy formulation and implementation processes, including the inclusivity of role players with national departments and institutions in formulating policy.

4.1 | NSI Policy Development Process Environment

The analysis of the NSI policy development processes resulted in three separate elements: coordinated participation, inclusivity in NSI policy development and participation by actors in policy development.

4.1.1 | Coordinated Participation

Coordinated participation significantly enhances the quality of responses and promotes inclusivity in policy development. Respondent 1 emphasised the importance of involving all actors to reduce overlaps in the formulation process. Respondent 2 noted that stakeholders are engaged across multiple platforms, with a top-down communication approach that includes executives representing various organisations. According to Respondent 4, several interdepartmental structures exist to facilitate information sharing regarding policy changes and developments, with regular meetings fostering active participation to ensure early buy-in from the department. While overlaps are common, they are generally addressed at the ministerial level, although some implementation aspects may be duplicated, complicating the development of NSI policies. Effective communication occurs through various platforms, including portfolio committee meetings and clusters like the Economic Sectors, Employment and Infrastructure Development (ESEID) Cluster, which aim to align departmental intentions with policy formulations.

4.1.2 | Inclusivity and Stakeholder Engagement in NSI Policy Development

Most respondents agreed that the stakeholders are engaged in all levels of policy development. The consultation is extensive; the stakeholders are informed from the first draft and participate in policy reviews. They contribute during the various engagements with CEOs and in workshops. The actors also contribute to responses when official letters are sent to the various departments, so all actors/stakeholders are privy to involvement. However, some respondents pointed to the need to improve stakeholder engagement by scheduling engagement earlier to allow inclusivity.

Respondent 4 had this to say:

My department deals by and large with public policies, so public participation is of utmost importance. In the context of Indigenous knowledge policies and subsequent legislations, the department has an obligation that stems from the fact that these are section 76 Bills which affect the provinces and as such robust consultations are mandatory.

4.1.3 | Incremental NSI Policy Review

Approach—Review of Old Policies

Respondent 1 further indicated that the NSI policy review starts with analysing the previous policy. This strategy is known as incrementalism and aims to achieve significant changes in the various laws or policies by gradually making minor adjustments to the NSI policies. The idea behind incrementalism, according to the participants, is to modify the NSI policies gradually as opposed to all at once.

4.1.4 | Participation by Actors in Policy Development

Actors were not adequately involved in the participation process. The analysis pointed to three issues: a problem with a top-down approach, inadequate consultation and poor communication during the NSI policy review.

Respondent 29 has this to say;

The process of informing institutions is hierarchical, where junior staff are uninformed and non-involved. Moreover, there is poor communication during the NSI policy review.

Respondents 10, 11 and 30 said that a top-down management style can isolate decision makers from the project team. In contrast, a bottom-up approach enables decision makers to stay directly engaged with the project. The leadership may reach poorly informed conclusions without the team's input or feedback.

4.2 | NSI Actors' Responses to the National Policy Imperatives of Harmonisation

The analysis of responses to the national policy imperatives of harmonisation showed that the actors understand their roles and the need for networking.

The respondents identified platforms such as workshops and the formation of working groups as the starting point. Networking improves harmonisation and comprises relationships between actors, international partners and the industry.

There are incidents highlighted where the actors' interest in the NSI policies has been waning. Respondents 9, 15 and 29 state that this is aggravated by a lack of understanding of the actors' roles and responsibilities. Thus, increasing interest by actors is one way the DSI entices organisations to respond to this imperative of harmonisation. It was noted that the level of involvement depends on the actors' interest.

4.2.1 | A Bottom-Up Approach to Policy Development

Respondents highlighted that harmonisation could be achieved through decentralised authority or other competitive processes. As indicated by Respondent 1, the relevant bodies, including

those affected, should be part of the initial decision-making process when the groundwork is done. Thus, a more bottom-up approach will involve relevant departments and organisations in the changes and policy changes.

4.2.2 | Ensuring a Thorough Understanding of Policies by Actors

Another way highlighted by respondents to guarantee the imperative of harmonisation is by ensuring a thorough understanding of policies by actors. Respondents 8, 22 and 30 indicated that thorough unpacking, discussion, and understanding of the policies by primary organisations would increase understanding. Before the policy is distributed, workshop training is conducted for all actors to provide an overview of what the government department hopes to accomplish and, after the agencies have commented, to attempt to grasp the various viewpoints. This conversation helps ensure that the contributions to the document point the NSI in the proper direction.

4.2.3 | Establishing Opportunities for Engagement Forums

Respondents 13, 17, 20 and 29 identified establishing opportunities for engagement forums as one way of responding to the imperative of harmonisation. Various engagements and involvements with other organisations at the very top level exist, including the forums formed for executives.

4.2.4 | Establishing Partnerships, Collaboration, and Consultation Among Organisations

Establishing partnerships and collaboration among organisations is another key response that respondents 10 and 13 revealed. According to respondent 11, the partnerships improve opportunities for engagement. Partnerships and collaborations can be among the actors themselves, and actors can lead some systems and interrogate the overlaps. For example, the NRF had started working with other agencies within the NSI to assist in maximising outputs for the sector. One leading example was that of the NRF, which had partnered with TIA on some of the programmes for impact research. It was revealed that the NRF signed a memorandum of understanding with the Human Sciences Research Council (HSRC) and will still forge more collaborations to close the gaps. In this regard, one respondent 8 had this to say:

The issue of working together will assist us as an institution; several agencies can assist with various elements in the name of harmonisation and collaboration.

In addition, the respondents noted that policy harmonisation requires collaboration between the appropriate government departments at the highest levels and should include formal inter-governmental agreements at the senior levels (DDG or even DG, depending on the nature of such harmonisation).

Frequent meetings by sister organisations to establish the alignment and gaps between policies featured prominently. Thus, respondents called for continuous consultation with all stakeholders, such as other government departments, NGOs, businesses, communities and traditional authorities.

4.2.5 | Mapping of Organisations Doing the Same Work

There is also a process of institutional mapping of the agency doing the same work that will be affected by the NSI policy to engage with them better. The actors, through respondents 10 and 30 revealed that this mapping also assists in eliminating duplications and enhances the integration of work. Actors can also know the dependencies they may have on other actors. According to respondent 13, mapping the actors that execute similar work assists in establishing and forging productive partnerships.

4.3 | Challenges in the Implementation of NSI Policies

The analysis of challenges reflected by DSI in implementing NSI policies resulted in four separate codes: a lack of continuity, challenges in implementing NSI policies, a lack of human and financial resources to drive policy implementation, a lack of political will and poor communication.

4.3.1 | A Lack of Continuity

Respondents 12, 19 and 20 cited a lack of continuity as a significant challenge. This is aggravated by the actors working in silos, leading to confusion in roles and tasks. Respondent 15 also alluded to the fact that poor organisational communication hurts the continuity of NSI policy development processes functions. Respondents 24 and 28 also identified gatekeeping as the most significant challenge that affects continuity. For example, it was noted that the change of ministers also impacts the implementation, as some choose to ignore strategies developed by the previous minister.

Most respondents noted that the country had many policies and strategies. However, the implementation aspect was failing, the challenge being that as one policy is approved, promulgated, and enacted, a new minister or new government comes in, the policy changes; hence, there is no continuity.

4.3.2 | A Lack of Human and Financial Resources to Drive the Policy Implementation

A lack of human and financial resources to drive policy implementation was identified as a challenge. Respondents 25 and 28 noted that there needed to be more budgetary provisions due to competing demands. In addition, there needs to be more human capital capacity to motivate the NSI policies to the budget steering committees. This has resulted in the resources allocated to this process being regarded as secondary.

4.3.3 | A Lack of Political Will

Another challenge heightened by respondents 26 and 30 was a lack of political will that creates difficult obstacles to policy integration. Thus, those who hold power are supposed to act for the common good and against their self-interest. It was noted that many political office bearers are often under pressure from political leaders and end up making decisions against the progress made by NSI policies.

4.3.4 | Poor Communication

The actors also cited poor communication. Respondent 29 mentioned that the department's communication office needs constant communication about all the work and activities the department is engaged in, including highlighting the available policies. Unfortunately, this still needs to be done. Respondents 24, 26 and 28 also argued that publicity via social media would ensure that ordinary people know what is happening. In addition, Imbizos can assist in communicating the department's policies. Respondents 25 and 28 revealed that policy communication rests with the department and the policy's owner.

4.4 | Challenges in the Implementation of NSI Policies by Actors

A similar analysis was conducted on the challenges faced by actors in implementing NSI policies, which resulted in seven different codes: a lack of financial resources, brain drain, a lack of skills, duplications of work, incoherence and fragmentation, managing an ever-changing environment, poor communication, poor understanding of policy imperatives and red tape.

4.4.1 | A Lack of Financial Resources

A lack of human and financial resources to drive policy implementation was identified as a challenge. Respondents 20, 26 and 30 noted that more budgetary provisions were needed due to competing demands. In addition, more human capital capacity was needed to motivate the NSI policies to budget-stuttering committees.

4.4.2 | Brain Drain and a Lack of Skills

Through respondents 18 and 21, the actors observed the challenge of academic brain drains and ageing academics with no youthful scientific community coming through. According to respondents 13 and 19, brain drain and a lack of skills result in poor understanding of policy imperatives, incoherence and fragmentation in NSI policy development processes.

4.4.3 | Incoherence and Fragmentation

Incoherence and fragmentation were noted as actors fulfil their tasks with little to no networking and collaboration. According to respondent 11, the incoherence and

fragmentation in policy development processes result in a poor understanding of policy imperatives. Respondents 10, 19 and 27 noted that more coordinated and structured engagements between institutions on common policy formulation issues and challenges are required. Respondents observed that no one is making plans to resolve incoherence and fragmentation. Another factor highlighted relates to the silo mentality, which is also prevalent among actors.

Respondent 27 had this to say

All institutions, private or public, should invest in research through the NRF. However, due to the disjointed system, some institutions bypass the NRF and invest directly in universities. That is the biggest challenge, as it creates much duplication and undermines the role of the NRF within the NSI.

4.4.4 | Managing the Changing Environment

Respondent 8's challenge is related to managing the ever-changing political leadership and education curriculum given the Industrial Revolution, global migration and rapid demographic, economic, technological and socio-political changes.

4.4.5 | Poor Communication and Red Tape

Three respondents, 8, 23 and 25, cited the lack of communication among the actors and rampant red tape. It was revealed that one must go through many doors to at least get something across. According to respondent 9, poor communication has the propensity to aggravate incoherence and fragmentation in NSI policy development processes and a poor understanding of policy imperatives.

4.4.6 | Poor Understanding of Policy Imperatives

In this regard, respondents indicated a need for preparation in response to other agencies' policy imperatives, so the agencies themselves do not prepare how they want to influence the policies. Respondents 8, 22, and 29 cited a lack of human capacity in policy engagement.

5 | Discussion

This section discusses the study findings from the three themes:

The analysis of the NSI policy development processes resulted in three separate codes: coordinated participation, inclusivity in NSI policy development and participation by actors in policy development.

Coordinated participation significantly enhances the quality of responses and promotes inclusivity in policy development. Coordinated participation enhances policy development by promoting inclusivity and improving response quality (Petersen

and Kruss 2018). Stakeholder involvement increases the knowledge base for policy development and creates broader consensus (Organisation for Economic Cooperation and Development (OECD) 2024). Policy networks play a crucial role in inclusive and responsive policy formulation by involving various actors and interest groups, leading to more informed decisions and increased legitimacy (Iihami 2023). Participatory approaches can broaden problem frames and address institutional and strategic uncertainties more actively (Petersen and Kruss 2018).

Inclusivity in NSI policy development requires that all actors be involved to reduce overlaps in the formulation process. Inclusivity in NSI policy development involves extensive stakeholder engagement from initial drafts through reviews. Inclusive innovation policies are crucial for addressing inequality and social exclusion (Iihami 2023). Effective policy development requires extensive stakeholder engagement, involving diverse actors from initial drafts through reviews (Petersen and Kruss 2018). An adaptive policy-making approach, institutionalising review and learning mechanisms, can promote sustainable innovation systems (Organisation for Economic Cooperation and Development (OECD) 2024).

Finally, in response to participation by actors in policy development, actors faced inadequate participation, stemming from a top-down approach. Respondents expressed the need for improved engagement, highlighting poor consultation and communication, which isolates decision makers and hinders project team input.

According to Ariti et al. (2019), policy development often suffers from inadequate participation due to top-down approaches. Studies in Ethiopia and Manitoba reveal that despite constitutional mandates for participatory processes, policies are frequently developed at higher levels and implemented downwards, limiting input from lower-level institutions and local stakeholders (Ariti et al. 2019). While participation can enhance empowerment, incorporate local knowledge and improve project responsiveness, it faces limitations such as failing to challenge existing power structures and overlooking complex local dynamics (Mubita et al. 2017). To improve engagement, suggestions include adapting approaches to local conditions, conducting careful political and social analyses and employing more complex consultative methods at the normative policy planning level (Mubita et al. 2017).

5.1 | NSI Actors' Responses to the National Policy Imperatives of Harmonisation

Respondents identified the role organisations/actors play in the harmonisation and noted the need for partnerships and collaboration among organisations. Various engagements and involvements with other organisations at the top level, including the forums formed for executives, are already taking place.

The results expanded on the aspect of harmonisation, highlighting that greater networking improves harmonisation in which the actors have been thriving. The problem identified was little to no collaboration, thus contributing to fragmentation and incoherence; the 2019 White Paper on Science and Technology acknowledges this and emphasises that the actors need to have

structured engagements that enable collaborations (Department of Science and Innovation (DSI) 2019).

The respondents noted that policy harmonisation requires collaboration between appropriate government departments at the highest levels and should include formal intergovernmental agreements at the senior levels (DDG or even DG, depending on the nature of such harmonisation). Findings revealed that harmonisation is achievable through various ways, such as the need for collaboration between the appropriate government departments at the highest levels, and formal intergovernmental agreements should be included at the senior levels. Hudson et al. (2019) found that agreements are primarily based on a particular department's level of interest. There is also a need for meetings by actors to establish the alignment and gaps between policies. Walwyn and Naidoo's (2020) findings indicated the need for engagement so that various policy instruments can identify how they can support each other.

Respondents called for continuous consultation with all stakeholders, such as other government departments, NGOs, businesses, communities, and traditional authorities. Mapping the actors executing similar work helps establish and forge productive partnerships. This is supported by the 2017 committee report, which noted that continued partnerships would contribute to harmonisation. The DSI and the NSI actors concurred that there is an overlap in implementation aspects but not in mandate. This was reviewed in literature through Ranga and Etzkowitz's (2013) findings that actors complement one another in an overlapping and substitutional manner, therefore balanced. The findings noted that there are no concentrated efforts to resolve the fragmentation. The DSI white paper of 2019 accepts its previous shortcomings in dealing with fragmentation. Hence, the 2019 white paper focuses on addressing fragmentation.

A need for officials in the various agencies to be capacitated to engage with the policy at various levels has been identified. Mbula and Vincent (2016) also found that a limited number of stakeholders may critically engage with policy. The NRF has started working with other agencies within the NSI to maximise sector output. The NRF is in the process of institutional mapping other agencies within the NSI that are stakeholders of the NRF and are in a similar implementation space; this will ensure that the NRF enhances engagement with those institutions, including in the policy development process. The respondents revealed that this mapping also assists in eliminating duplications and enhances the integration of work. The mapping of actors that execute similar work will assist in establishing and forging productive partnerships and networks.

5.2 | Challenges in the Implementation of NSI Policies

The analysis of challenges in implementing the NSI policies identified several challenges discussed in this subsection. The respondent identified three main challenges: lack of continuity, challenges in implementing NSI policies, and a lack of human capacity and financial resources to drive policy implementation. Academy of Science of South Africa (ASSAf) (2013) found that human resources are inadequately matched to the requirements

of the NSI. The respondents attribute this to the lack of continuity. This is aggravated by the actors working in silos, leading to confusion in roles and tasks. Findings also cited the lack of human capacity in policy engagement. Mbula and Vincent (2016) concluded that although not generally available to most actors, the opportunity struggles with policy engagement and sufficiently contributing to the policy. The results also noted a noticeable brain drain due to a lack of skills, resulting in a poor understanding of policy imperatives and policy development processes. Khan and Rahman (2017) concurs by indicating that there is a brain drain, hence the need for the DSI to increase the development of young academics and researchers. Brain drain and a lack of skills result in a poor understanding of policy imperatives, incoherence and fragmentation in NSI policy development processes.

Respondents noted the need for more budgetary provisions due to competing demands. Moreover, respondents said the lack of political will creates obstacles to policy integration. Thus, those who hold power are supposed to act for the common good and against their self-interest. It was noted that many political office-bearers are often under pressure from their political leaders and end up making decisions against the progress made by NSI policies.

Some respondents mentioned that the lack of communication was caused by rampant red tape. This shows that fragmentation and a lack of integration in NSI policy development are aggravated by poor communication and a lack of inclusivity during the policy development process. Information sharing was identified as a key feature in addressing a lack of inclusivity during the policy-making process.

The respondents note incoherence and fragmentation in policy development processes, resulting in a poor understanding of policy imperatives. In addition, they emphasised the importance of being prepared to respond to the policy demands of other agencies. This is crucial to ensure that agencies do not independently shape policies based on their interests, which can lead to further incoherence and fragmentation in the National System of Innovation (NSI) policy development process. Therefore, more coordinated and structured interactions are needed between institutions to address common issues and challenges in policy formulation (Lehmann and Schenkenhofer 2020).

The respondents highlighted that poor communication within organisations negatively impacts the continuity of NSI policy development processes. Walwyn and Naidoo (2020) discovered that administrative challenges related to various innovation instruments stemmed from a lack of communication or a lack of awareness regarding the implementation of policy intent.

Incoherence and fragmentation, exacerbated by a silo mentality within operations and policy development processes, lead to a poor understanding of policy imperatives. Von der Heyden et al. (2016) point out that this silo mentality hampers communication among policymakers and officials during the policy development phase. Ineffective communication can hinder the development of stakeholders and result in inadequate consultation processes (Trein and Ansell 2021).

There was a general agreement that the policies, as well as the roles and activities of the department and organisations, were

not well communicated. Internal communication must be enhanced at the organisation level, as information often remains with management and does not reach the entire organisation. The DSI must also consider the role it plays in communication. This, therefore, solidifies the findings, highlighting the hindrance of red tape and the top-down approach and how these barriers do not allow for fluid communication.

6 | Conclusion

From the policy development aspect, policy development is prescribed by national frameworks and is adhered to by the actors. This includes the key element of stakeholder consultation of the various actors in policy development by the Department of Science and Innovation. The top-down approach in policy engagement and consultation leads officials working at the organisation's junior levels to see themselves as people responsible for delivering technical support instead of identifying themselves as important players in policy development and innovation. This has led to interviewed executives indicating intensive consultation. There are incidences highlighted where the actors' interest in the NSI policies has been waning.

A lack of understanding of the roles and responsibilities of actors aggravates this. Thus, increasing interest by actors is one way the DSI entices organisations to respond to this imperative of harmonisation. It was noted that the level of involvement depends on the actor's interest. The analysis indicates that establishing engagement opportunities improves the quality of consultative processes in policy reviews. Interestingly, respondents noted that the policy development of other actors/departments is indeed communicated. However, it is communicated to the CEO, who is informed of the intention for policy development at the cohort level, and the agency is expected to be self-initiated; this is an area of consideration for policymakers as they claim to have engaged institutions whilst they only engaged with two or three officials from the agency. This questions whether departments have a role in ensuring that information trickles down. The communication depends on the executive's leadership style, and perhaps there must be a standard way of engaging agencies.

Several recommendations can be derived from the study on the various key aspects of the NSI challenges. The proposed measures are as follows:

First, communication and inclusivity should be improved to address fragmentation in NSI policy development. Aligning the efforts of various stakeholders will minimise overlaps and foster collaboration rather than isolated actions.

Second, stakeholders should familiarise themselves with each other's policies to harmonise development. Effective information sharing can enhance partnerships and reduce fragmentation in the policy-making process.

Third, government departments must consult with communities and stakeholders before developing policies. Policy translations in all official languages will encourage participation and move away from a top-down approach.

Fourth, organisations should revise their policies and strategies every three to 5 years to adapt to the evolving political landscape and societal changes, particularly in light of global trends and the Industrial Revolution.

Fifth, local and international collaborations should be strengthened to stay aligned with emerging trends and foreign policies. Ongoing partnerships will facilitate harmonisation across different sectors.

Sixth, implement micro-adjustments over time, using a gradual approach to policy changes. This incremental strategy will promote seamless NSI implementation and enhance coordination among government departments.

Finally, develop a tailored plan to ensure all stakeholders are included in the policy-making process. This will bridge the divide between policy formulation and practical implementation, ensuring effective policies are developed and executed.

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The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The datasets generated and/or analysed during the current study are available in the (University of Pretoria) repository, <https://doi.org/10.25403/UPresearchdata.25285921>.

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